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(54) Battery pack

(57) In a battery pack, it is required that information on a contained battery (23) of the battery pack, such as the accurate state of charge of the battery (23), can be detected by external equipment (27). A communication terminal (24) which can communicate the state of charge of the contained battery (23) to the external equipment (27) is provided on the installation surface on which power supply terminals (25, 26) of the battery pack are provided or on a surface adjacent to the installation surface. This configuration allows the corresponding electrodes (30, 31) or the like of the external equipment (27) to be concentrated at one place, so that the space required to arrange the corresponding electrodes (30, 31) or the like is reduced, thus allowing for downsizing of the external equipment (27).

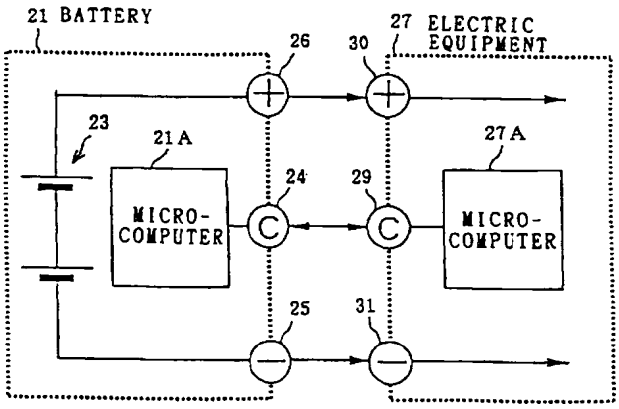

FIG. 4

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Description

[0001] This invention relates to a battery pack, and particularly, but not exclusively, to a battery pack which supplies DC power to electronic equipment.

[0002] Today, many battery packs are commercially available, which contain one or more batteries to supply DC power to portable electronic equipment. A wide variety of battery packs, including those which are rechargeable or non-rechargeable and those which have specific applications, are on the market. Electronic equipment therefore is likely to be loaded with inappropriate battery packs, thus causing the malfunction of the equipment or damage thereto. A mechanism that is intended to prevent an inappropriate battery pack from being accidentally loaded into electronic equipment is thus incorporated in battery packs. As an example, a battery pack for a videotape recorder with a camera is shown in Figs. 1 and 2A to 2C. Figs. 2A, 2B and 2C show a plan view, a side view, and a bottom view of the battery pack, respectively.

[0003] The battery pack 1 comprises a case consisting of an upper case 2 and a lower case 3, which are provided with a fitting mechanism to prevent the loading of an inappropriate battery pack. A groove 2A on top of the upper case 2 is for preventing the battery pack from being inserted into equipment in an incorrect direction. The battery pack is designed so that if the battery pack is by accident inserted into equipment in an opposite direction, a part of the upper case 2 that is not grooved rests against a guide rail in the equipment to prevent the battery pack from being inserted into the equipment.

[0004] On the other hand, the lower case 3 is provided with concave portions 4, 5, 6 and 7 along the center line X-X and with a concave portion 8 along a side surface. The concave portions 5 and 8 are detection holes, and the concave portion 6 is a locking hole used to install the battery pack to electronic equipment of external battery installation type. More specially, the concave portions 4 and 7 are a spare detection hole and a detection hole indicating that the battery pack contains a lithium ion battery, respectively. The concave portion 8 is a detection hole indicating that the battery pack is rechargeable.

[0005] The lower case 3 is also provided at the side surfaces and bottom surface thereof with grooves 9A, 9B, 10A and 10B to install the battery pack to electronic equipment of external battery installation type. A marker 13 indicating the state of charge of the battery, installed on the side surface of the lower case 3 on which power supply terminals 11 and 12 are provided, allows a determination as to whether the battery pack is fully charged or depleted.

[0006] As described above, a conventional battery pack is designed so that it can be determined, by seeing whether or not. convex portions fit into corresponding detection holes, whether or not the battery pack is attachable to electronic equipment or a charger.

[0007] Recently, electronic equipment has been required to perform more and more functions and provide more accurate information. Such information includes the state of charge of the battery and output current amperage.

[0008] EP-A-0661769 discloses a three-terminal battery pack which includes a T-terminal for permitting thermal measurement of the battery and, in addition, permits data transfer therethrough.

[0009] EP-A-0572327 discloses a battery pack which includes power supply terminals each provided in a recessed wall portion of the casing, and a temperature sensing terminal provided towards the middle of the bottom surface of the casing.

[0010] In one aspect the present invention provides a battery pack, comprising: a casing provided with a communication terminal and power supply terminals, wherein the power supply terminals are provided on one surface of the casing and the communication terminal is provided on at least one of the one surface of the casing and a surface adjacent to the one surface of the casing, and the communication terminal and the power supply terminals are provided at the front end of the casing in the direction of insertion of the battery pack to exterior equipment; a battery housed by the casing; and a microcomputer housed by the casing, the microcomputer being operable to communicate a detected state of charge of the battery to exterior equipment through the communication terminal.

[0011] In a further aspect the present invention provides a battery pack, comprising a microcomputer and means of communicating the state of charge of a contained battery detected by the microcomputer through a communication terminal, wherein the communication terminal is provided on the installation surface on which power supply terminals are provided or on the surface adjacent to the installation surface.

[0012] In such a battery pack information on the battery in the battery pack can accurately be communicated to external equipment.

[0013] This arrangement allows the electrodes or the like of external equipment, which correspond to the communication and power supply terminals, to be concentrated at one place and the space required to arrange the electrodes or the like to be reduced, thus allowing for a reduction in the size of the external equipment.

[0014] The present invention will now be described hereinbelow by way of example only with reference to the accompanying drawings, in which:

Fig. 1 is a perspective diagram showing the constitution of a conventional battery pack;

Figs. 2A to 2C are schematic diagrams explaining a plan diagram, a side diagram, and a bottom diagram of a conventional battery pack;

Fig. 3 is a schematic perspective diagram explaining a general constitution of a battery pack accord-

ing to the present invention;

Fig. 4 is a schematic diagram explaining an electrical inner constitution of the battery pack shown in Fig. 3;

Fig. 5 is a perspective diagram showing the constitution of a battery pack according to the present invention;

Figs. 6A to 6C are schematic diagrams explaining a plan diagram, a side diagram, and a bottom diagram of the battery pack shown in Fig. 5;

Fig. 7 is a schematic diagram showing an example of the constitution of equipment into which a battery pack is loaded;

Fig. 8 is a schematic diagram showing an example of the constitution of equipment in which a battery pack is installed; and

Fig. 9 is a schematic diagram showing a terminal constitution on a surface on which a battery pack is placed.

(1) Structure of Battery Pack

[0015] Figs. 3 and 4 schematically show the appearance and internal constitution of a battery pack.

[0016] First, a battery pack 21 is characterized in that accurate information on a contained battery 23 (such as amperage, voltage, and the state of charge of the battery), detected by a built-in microcomputer 21A, can be communicated to a microcomputer 27A of external equipment 27 through a communication terminal 24.

[0017] Second, the battery pack 21 is characterized in that the communication terminal 24 is provided near either a negative (-) power supply terminal 25 or a positive (+) power supply terminal 26. In this embodiment, the communication terminal 24 is provided near the negative (-) power supply terminal 25. This is because the negative (-) power supply of the microcomputer 21A is connected to the negative (-) power supply terminal 25, and overvoltage is prevented from being applied to the microcomputer 21A even if the communication terminal 24 and the negative (-) power supply terminal 25 are accidentally short-circuited.

[0018] In addition, the communication terminal 24, which is provided to lie in both the front surface, on which the negative (-) power supply terminal 25 and positive (+) power supply terminal 26 are provided, and the bottom surface of the battery pack 21, is intended to come into contact with a communication terminal of the external equipment regardless of whether or not the front surface or the bottom surface comes into contact with the external equipment.

[0019] Next, Figs. 5 and 6A to 6C show another embodiment of the battery pack 21. The constitution is similar to that of the battery pack 1 shown in Figs. 1 and 2A to 2C, but differs from conventional constitutions in terms of groove length so that the battery pack 21 can mechanically be found to have a communication function. Basically, the battery pack 21 comprises a case consisting of an upper case 32 and a lower case 33.

[0020] For example, a groove 32A on a top surface of the upper case 32 is formed to be longer than the groove 2A shown in Fig. 1. This difference in groove length detects, in the equipment side to be inserted, whether or not the battery pack 21 incorporates a microcomputer. Thus, only equipment that utilizes microcomputer-containing battery packs can be loaded with the battery pack 21. The groove 32A also prevents the battery pack 21 from being inserted into external equipment in an incorrect direction.

[0021] Further, a groove 34, similar to the groove 32A, provided at a bottom surface of the lower case 33 is formed to be longer than the groove 7 shown in Fig. 2C. In the case where the bottom surface of the lower case 33 comes into contact with the equipment into which the battery pack 21 is loaded, the groove 34 allows a determination as to whether or not the battery pack 21 incorporates a microcomputer. Thus, only equipment that utilizes microcomputer-containing battery packs can be loaded with the battery pack 21.

[0022] In addition, in the bottom surface of the lower case 33, concave portions 35, 36 and 37 are provided along a center line X-X, and a concave portion 38 is provided in a side surface.

[0023] The concave portion 36 indicates that the battery pack 21 contains a lithium ion battery. The concave portion 38 indicates whether or not the battery pack 21 is rechargeable. The concave portion 37 is used for locking the battery pack 21 when loaded into electronic equipment of external battery pack installation type. The concave portions 36 and 38 thus allow a determination as to whether or not the battery pack 21 can be installed in chargers or electronic equipment.

[0024] A marker 39 showing whether or not a battery is charged, installed on the center line X-X on the side surface of the power supply terminals 25 and 26, allows a determination as to whether the battery pack 21 is fully charged or depleted. For example, if the battery pack 21 is fully charged, the whole marker 39 is exposed in the concave portion at which the marker 39 is positioned. On the other hand, if the battery pack 21 is in use or depleted, the marker 39 is partly located in the battery pack 21 such that the marker 39 is only partly exposed in the concave portion. When the battery pack 21 is removed from a charger after charging is complete, the marker 39 is pulled out of the battery pack 21, and when the battery pack 21 is loaded into equipment, a projection on the equipment pushes the marker 39 into the battery pack 21.

[0025] On the circumference of the bottom surface of the lower case 33, fitting grooves 40A and 40B having ribs are provided along one of the longer sides thereof, and fitting grooves 41A and 41B having ribs are provided along the other of the longer sides thereof. When installed on a battery holder exposed on a surface of a charger or electronic equipment, the battery pack 21 fits into the projections of the battery holder to be secured.

[0026] At the front end 33A of the lower case 33, indented surfaces 42 and 43, a step down from the surroundings thereof, are formed, on which the power supply terminals 25 and 26 are provided.

[0027] As described above, the power supply terminals 25 and 26 are provided on the indented surfaces 42 and 43, a step down from the surface of the front end 33A. Since the indented surfaces 42 and 43 differ in level from the installation surface for the communication terminal 24, a conductive member or the like is not likely accidentally to short-circuit the communication terminal 24 and the negative (-) power supply terminal 25. The power supply terminals 25 and 26 function as charging electrodes when the battery pack 21 is installed in a charger for charging purposes, while the power supply terminals 25 and 26 function as power supply electrodes when the battery pack 21 is loaded into electronic equipment for power supply purposes.

[0028] According to the battery pack 21 of the above constitution, placing the communication terminal 24, which is used for communicating the information of the internal battery 23 detected by the built-in microcomputer 21A to external equipment, on the installation surface on which the power supply terminals 25 and 26 are provided or near the installation surface allows the communication terminal and power supply terminals of electronic equipment, into which the battery pack 21 is loaded, to be concentrated at one place, thus reducing the terminal constitution of the electronic equipment in size.

(2) Structure of Equipment in which Battery Pack is Installed

[0029] Figs. 7 and 8 show examples of the constitutions of electronic equipment and a charger in which the battery pack 21 can be installed. The battery pack 21 may be inserted into the equipment or externally attached to the equipment. Fig. 7 illustrates the battery pack 21 being inserted into a videotape tape recorder 51 with a camera, and Fig. 8 illustrates the battery pack 21 being externally attached to a charger 61.

[0030] The battery pack 21 inserted into the videotape recorder 51 with a camera is described below. The videotape recorder 51 with a camera is provided under the view finder thereof with a space into which the battery pack 21 is to be inserted. Inside the space, electrodes are provided at positions corresponding to the electrodes of the battery pack 21, and convex portions are provided which correspond to the concave portions of the battery pack 21. For example, a projection 52 for preventing reverse battery pack insertion is formed to be as long as the groove 32A. As described above, the projection 52 prevents battery packs other than the above battery pack 21, having a communication function and containing a lithium ton battery, from being inserted into the videotape recorder 51.

[0031] Electrodes 30 and 31, indicated by broken lines in Fig. 7, are mated with the power supply terminals 25 and 26 of the battery tack 21 and electrically connected with the power supply terminals 25 and 26 to receive power supply when the battery pack 21 is loaded in the videotape recorder 51.

[0032] A communication terminal 29, mated with the communication terminal 24 of the battery pack 21, is connected with the communication terminal 24 of the battery pack 21 to receive information on the current from the lithium ion battery, the voltage, and the state of charge of the battery 23 when the battery pack 21 is loaded into the equipment. The communication terminal 29 gives a cue to the battery pack 21 to communicate information.

[0033] A charger 61 to be externally connected with the battery pack 21 is described below. A marker position changeover projection 62 and a locking projection 63 are provided along the center line of the installation surface of the charger 61 on which the battery pack 21 is located. The marker position changeover projection 62 pulls out the marker 39 when the battery pack 21 is removed, and the locking projection 63 secures the battery pack 21 to the installation surface. Fitting projections 64A, 64B, 65A and 65B are provided on opposed sides of the installation surface. These four fitting projections fit into the fitting grooves 40A, 40B, 41A and 41B of the battery pack 21.

[0034] The electrodes 30 and 31, which are to be connected with the power supply terminals 25 and 26 of the battery pack 21 to apply charging voltage to the battery pack 21, and the communication terminal 29, which is to be connected with the communication terminal 24 to communicate information on the battery 23, are positioned opposite to the power supply terminals 25 and 26 and the communication terminal 24, respectively. As shown in Fig. 9, the communication terminal 29 is arranged so as to come into contact with the communication terminal 24 of the battery pack 21 without failure.

[0035] Specifically, the communication terminal 29 consists of two spring terminals 29A and 29B so that the communication terminal 29 can elastically come into contact with the communication terminal 24 at two points. This allows at least one of the spring terminals 29A and 29B to securely come into contact with the communication terminal 24.

(3) Modifications

[0036] Note that, in the aforementioned embodiments, only battery packs 21 containing a lithium ion battery are described. However, the present invention is not limited thereto and other batteries can be applied as batteries for containing in packs.

[0037] Further, in the aforementioned embodiments, the communication terminal 24 of the battery pack 21 is formed to lie in not only the installation surface on which the power supply terminals 25 and 26 are provided but the bottom surface of the battery pack 21,

so that the battery pack 21 can be installed in equipment in two ways. However, the present invention is not limited thereto and the communication terminal 24 can be formed only on the installation surface on which the power supply terminals 25 and 26 are provided.

[0038] Furthermore, in the aforementioned embodiments, the power supply terminals 25 and 26 of the battery pack 21 are provided, being a step down from the installation surface of the battery pack 21, so that the communication terminal 24 and the power supply terminals 25 and 26 are at different levels. However, the present invention is not limited thereto and the communication terminal 24 and the power supply terminals 25 and 26 can be at the same level.

[0039] As described above, providing the communication terminal 24, used to communicate the state of charge of the contained battery 23 to external equipment, on the installation surface on which the power supply terminals 25 and 26 are provided or near the installation surface, allows the communication terminal and power supply terminals of electronic equipment, into which the battery pack 21 is loaded, to be concentrated at one place, thus allowing a reduction in size of the terminal constitution of the electronic equipment.

Claims

1. A battery pack, comprising:

   a casing (32, 33) provided with a communication terminal (24) and power supply terminals (25, 26), wherein the power supply terminals (25, 26) are provided on one surface of the casing (32, 33) and the communication terminal (24) is provided on at least one of the one surface of the casing (32, 33) and a surface adjacent to the one surface of the casing (32, 33), and the communication terminal (24) and the power supply terminals (25, 26) are provided at the front end (33A) of the casing (32, 33) in the direction of insertion of the battery pack to exterior equipment;
   a battery (23) housed by the casing (32, 33); and
   a microcomputer (21A) housed by the casing (32, 33), the microcomputer (21A) being operable to communicate a detected state of charge of the battery (23) to exterior equipment through the communication terminal (24).

2. A battery pack according to claim 1, wherein the communication terminal (24) and the power supply terminals (25, 26) are provided on the one surface of the casing (32, 33).

3. A battery pack according to claim 2, wherein the communication terminal (24) and the power supply terminals (25, 26) are provided on portions of the one surface of the casing (32, 33) that differ in level.

4. A battery pack according to claim 1, wherein the communication terminal (24) is provided on both the one and the adjacent surface of the casing (32, 33).

5. A battery pack according to any of claims 1 to 4, wherein the power supply terminals (25, 26) are provided in portions (42, 43) of the one surface of the casing (32, 33) that are indented with respect to another portion thereof.

6. A battery pack according to any of claims 1 to 5, wherein the communication terminal (24) is provided near the negative power supply terminal (25) of the power supply terminals (25, 26).

7. A battery pack according to any of claims 1 to 6, further comprising identification means for enabling identification of the kind of the battery (23).

8. A battery pack according to claim 7, wherein the identification means is configured to prevent the battery pack from being inserted improperly to exterior equipment.

9. A battery pack according to claim 7 or 8, wherein the identification means comprises a groove (34) provided in a surface of the casing (32, 33).

10. A battery pack according to any of claims 1 to 9, further comprising indication means (38) for indicating whether or not the battery pack can be installed in chargers or electronic equipment.

11. A battery pack according to any of claims 1 to 10, further comprising indication means (36) for indicating whether or not the battery (23) is a lithium ion battery.

12. A battery pack according to any of claims 1 to 11, further comprising display means (39) for displaying the state of charge of the battery (23).

13. A battery pack, comprising a microcomputer and means of communicating the state of charge of a contained battery detected by the microcomputer through a communication terminal, wherein the communication terminal is provided on the installation surface on which power supply terminals are provided or on the surface adjacent to the installation surface.

14. A battery pack according to claim 13, wherein the communication terminal is provided near the negative power supply terminal of a pair of power supply terminals.

15. A battery pack according to claim 13 or 14, wherein the surface on which the communication terminal is provided differs in level from the surface on which a pair of power supply terminals are provided, the two surfaces at different levels constituting the installation surface.

16. A battery pack according to claim 13 or 14, wherein the communication terminal is formed to lie on at least the installation surface and the surface adjacent to the installation surface.

17. A battery pack according to any of claims 13 to 16, further comprising determining means for determining the type of battery.

18. A battery pack according to claim 17, wherein the determining means has a function for preventing the battery pack from being inserted in an opposite direction into exterior equipment.

19. A battery pack according to claim 17 or 18, wherein the determining means is a groove which is provided on a surface of a case.

20. A battery pack according to any of claims 13 to 19, further comprising determining means for determining whether or not the battery is a lithium ion battery.

21. A battery pack according to any of claims 13 to 20, further comprising determining means for determining whether or not the battery is rechargeable.

22. A battery pack according to any of claims 13 to 21, further comprising display means for displaying the state of charge of the battery.

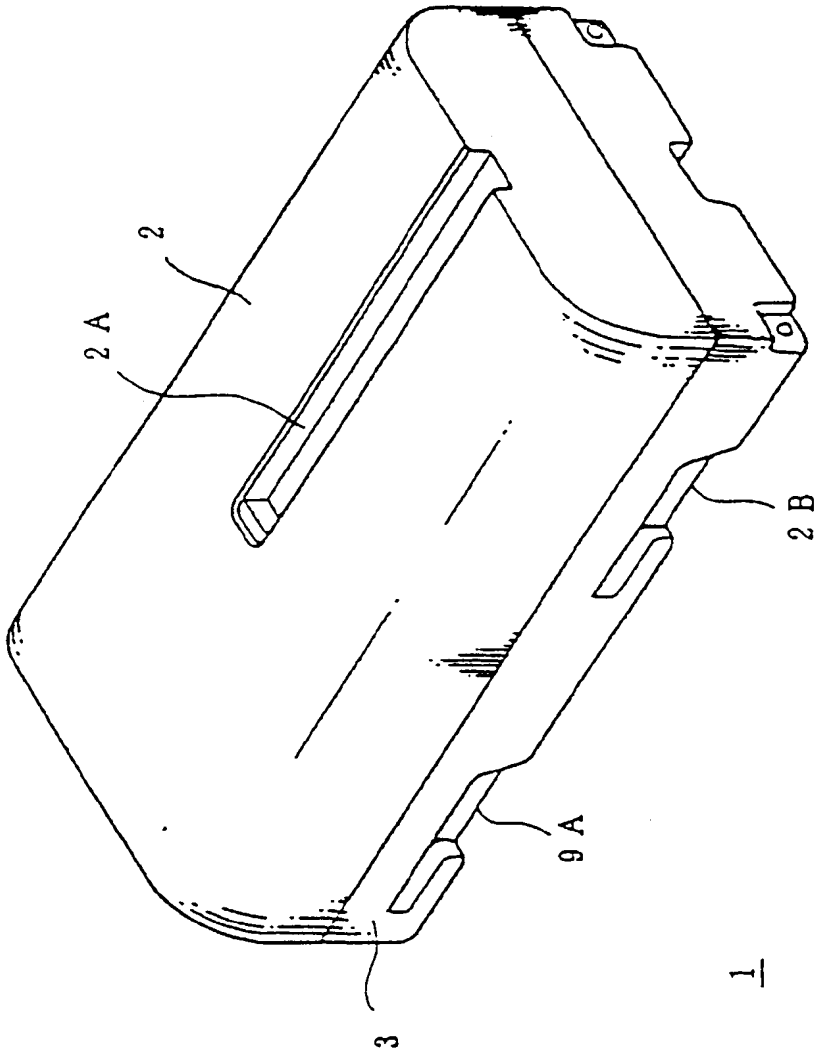

FIG. 1 (RELATED ART)

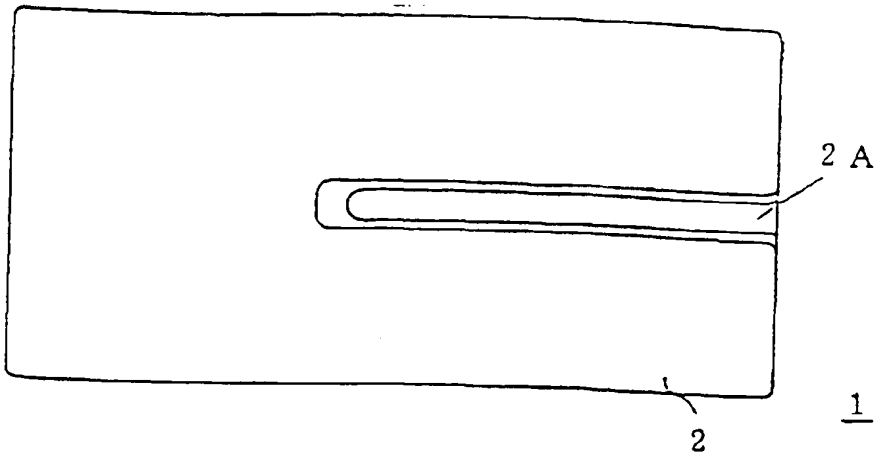

FIG. 2 A (RELATED ART)

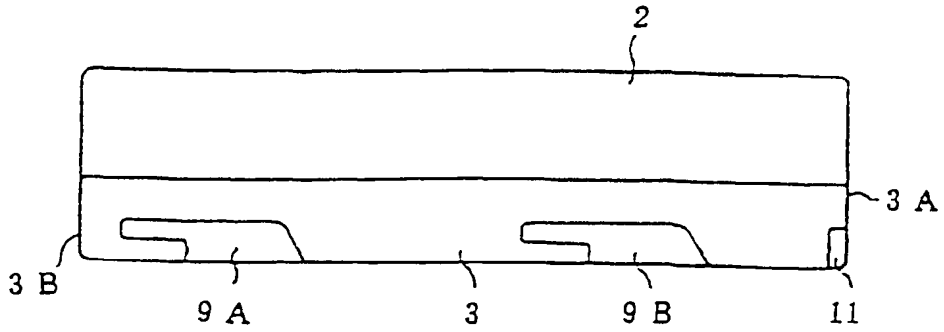

FIG. 2 B (RELATED ART)

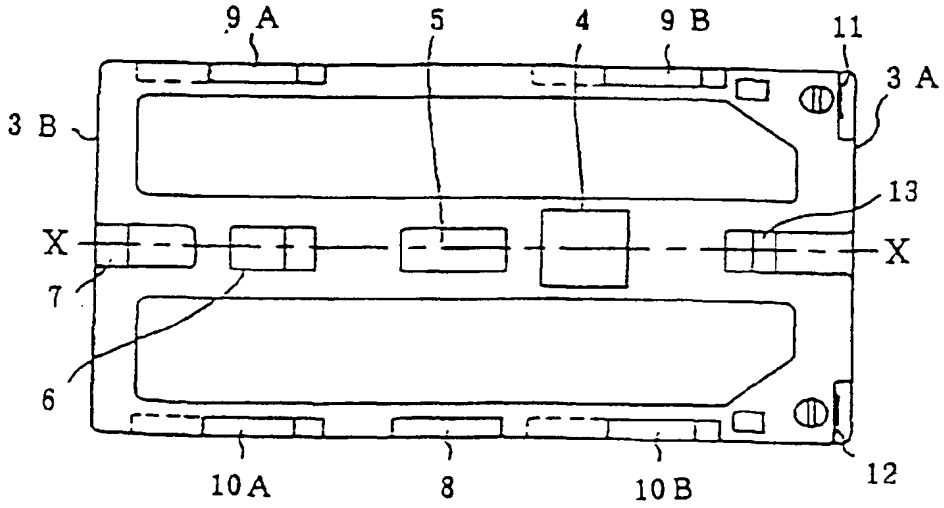

FIG. 2 C (RELATED ART)

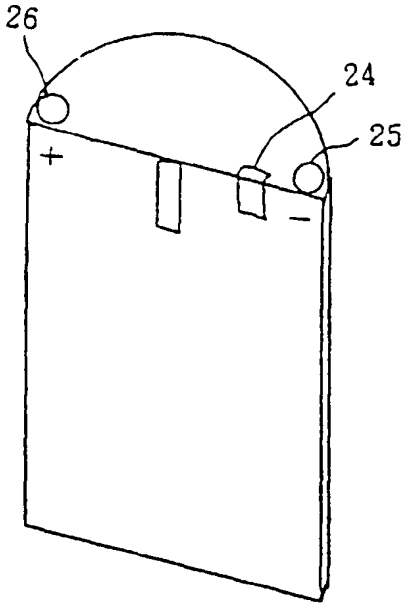

FIG. 3

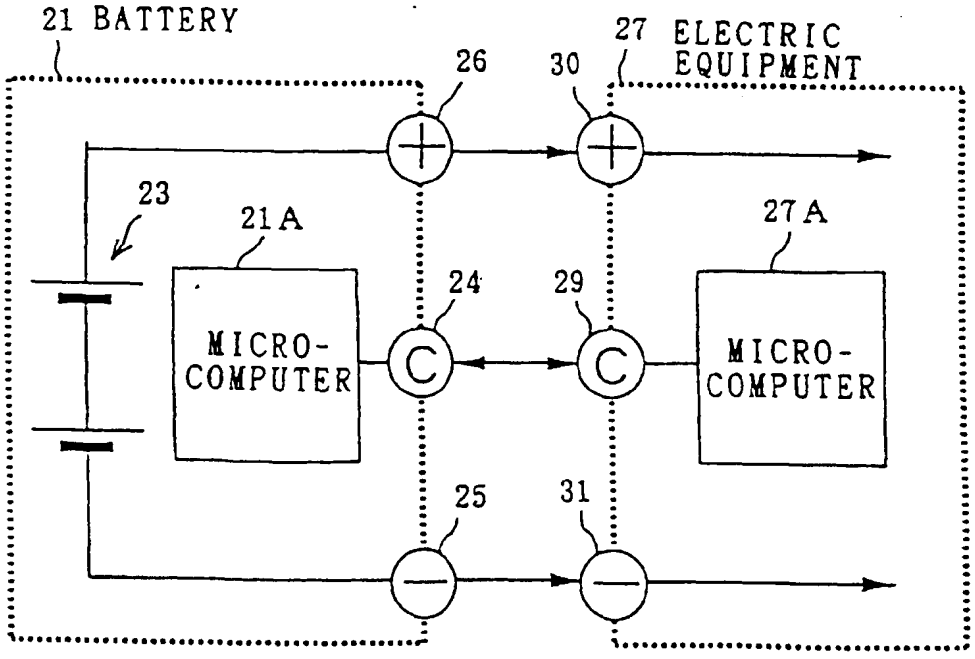

FIG. 4

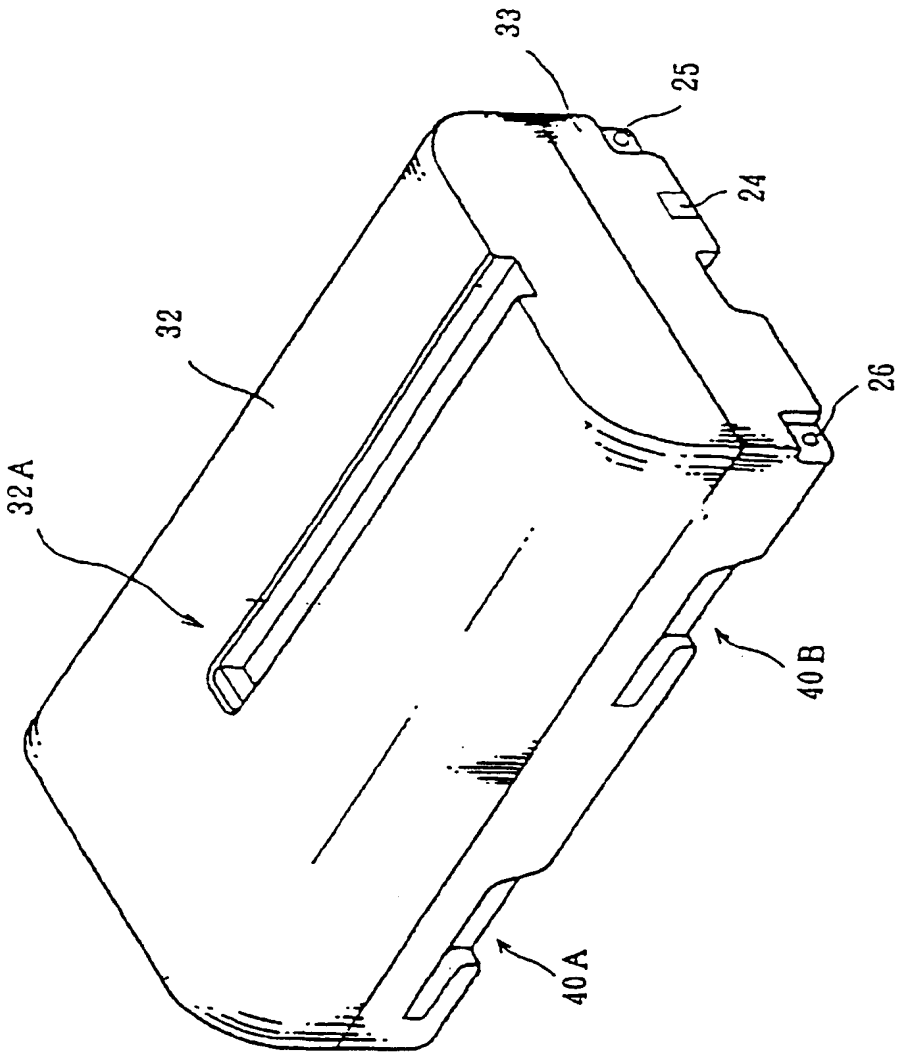

FIG. 5

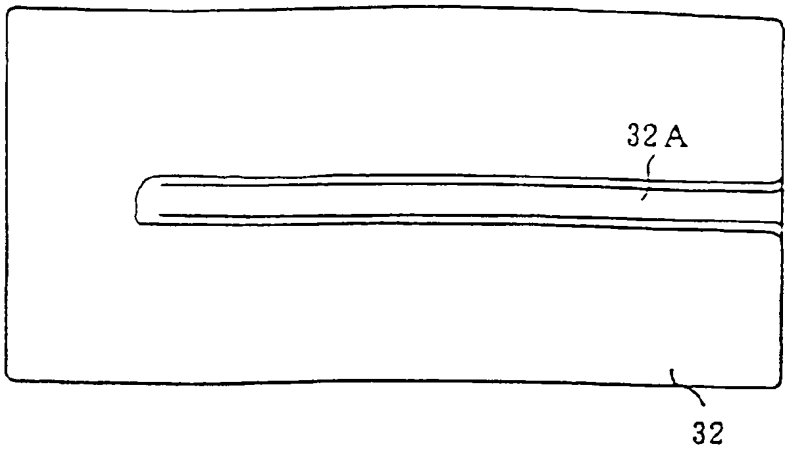

FIG. 6A

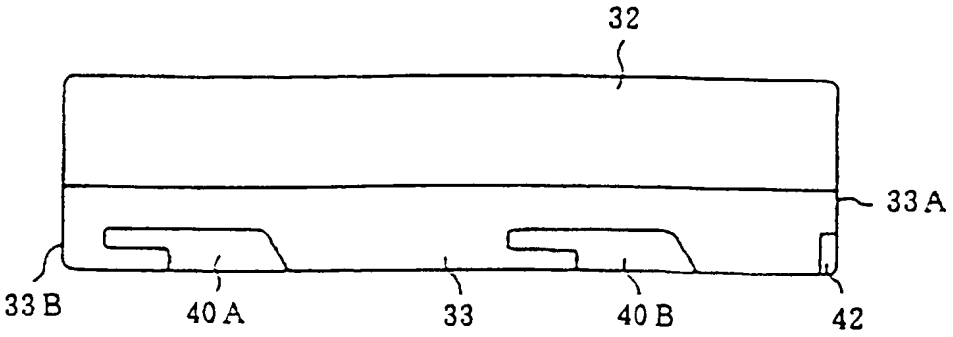

FIG. 6B

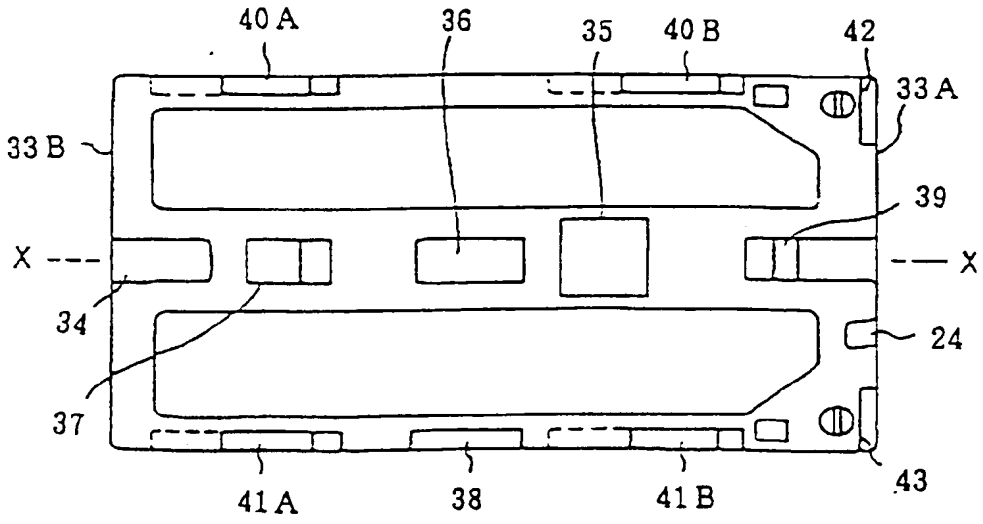

FIG. 6C

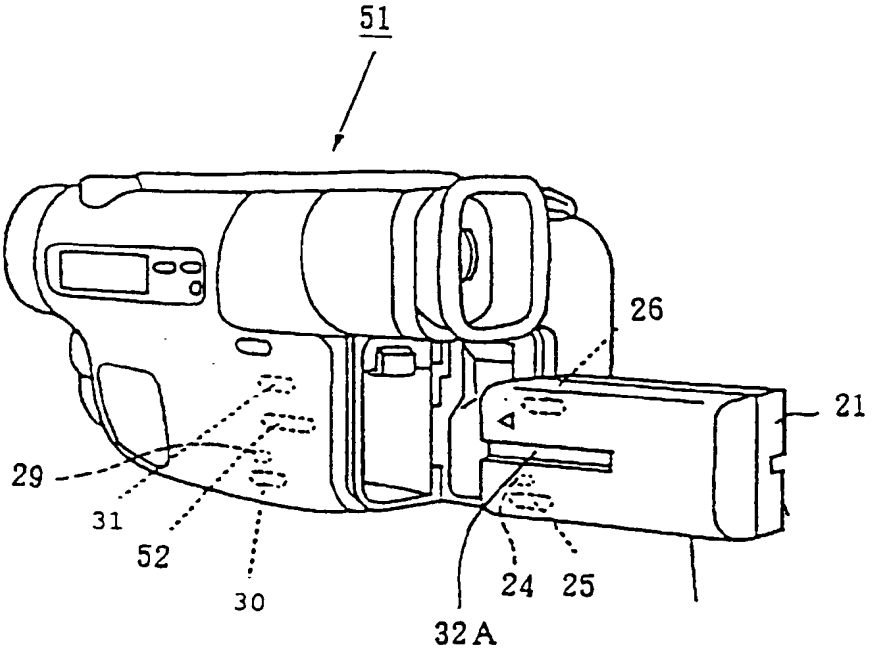

FIG. 7

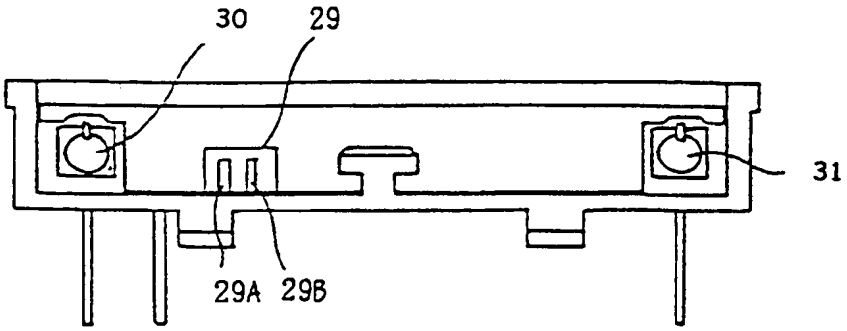

FIG. 9

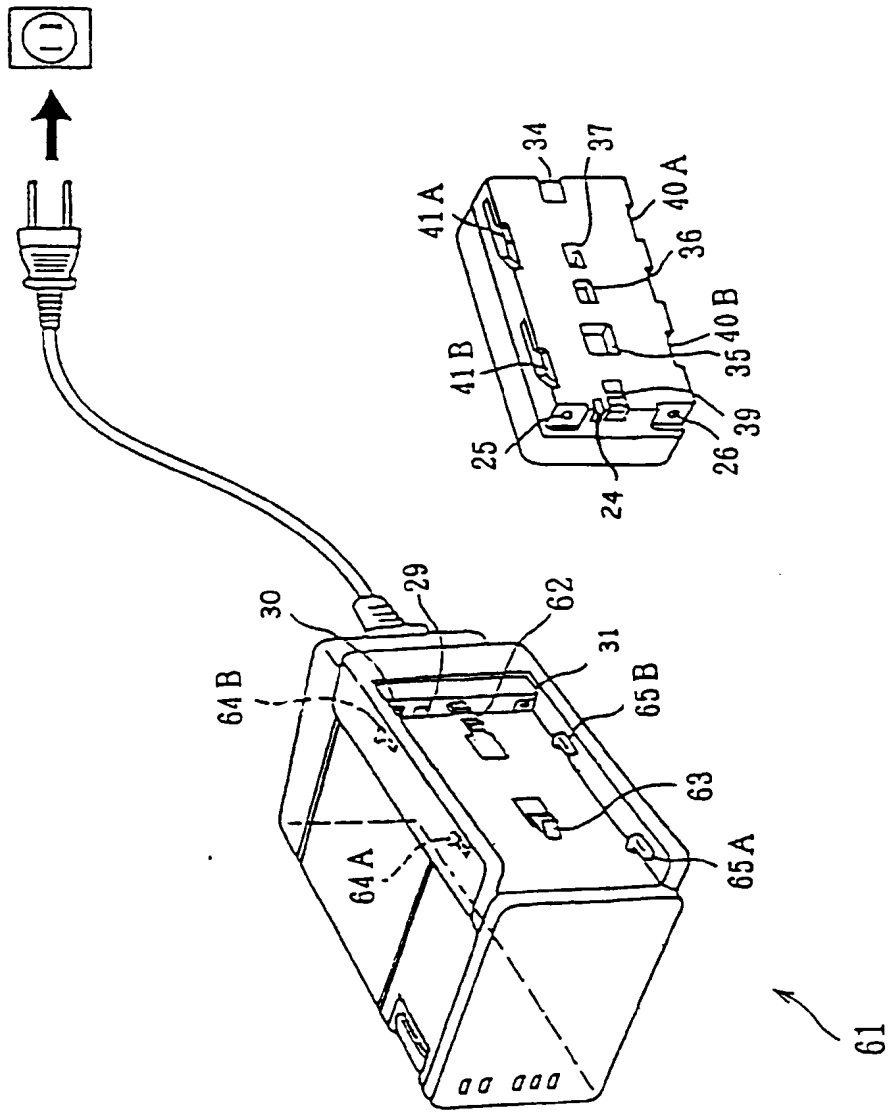

FIG. 8

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(54) Battery pack

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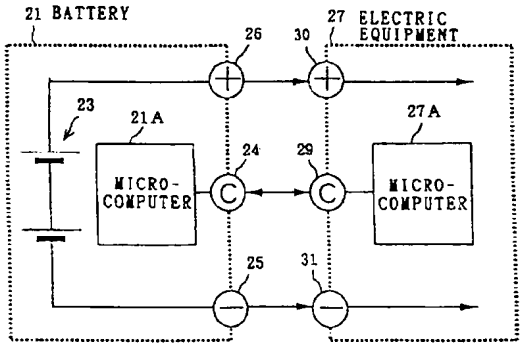

FIG. 4

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 12 1742

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 0 661 769 A (TEXAS INSTRUMENTS FRANCE ;TEXAS INSTRUMENTS INC (US)) 5 July 1995 (1995-07-05) * the whole document *	1	H01M2/34 H01M2/10 H01M10/48
A	EP 0 572 327 A (SONY CORP) 1 December 1993 (1993-12-01) * claims 1-20; figures 3B,4 *	1	
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